What is Claimed is:

1. A special effect device in which picture signals are read out from a frame buffer based on an address signal to impart a desired special effect to the picture signals read out from said frame buffer, the special effect device comprising

address signal generating means for generating readout address signals of said picture signals stored in said frame buffer so that the picture signals will be read out from said frame buffer on a display picture surface as an array of m × n reduced-size pictures, where m and n denote natural numbers.

2. The special effect device according to claim 1 wherein, when said m indicating the number of the reduced-size pictures arrayed along the x-direction is IMultipleX, said n indicating the number of the reduced-size pictures arrayed along the y-direction is IMultipleY, and the width and the height of the reduced-size picture output are W and H, respectively, said address generating means generates a read-out address signal (X, Y) of said picture signals, causing said m × n reduced-size pictures to be output, by the equation (1-1):

$$X = f_1(x)$$

$$Y = f_2(y) \qquad (1\text{-}1)$$

which equation (1-1) satisfies the equation (1-2) and (1-3):

$$f_1(x) = x \times \text{IMultipleX} \pmod{W} \qquad (1\text{-}2)$$

$$f_2(y) = y \times \text{ImultipleY} \pmod{H} \qquad (1\text{-}3)$$

where

W: (post-crop) picture width

H: (post-crop) picture height.

3. An address signal generating device for generating an address signal for reading out picture signals from a frame buffer, said address signal generating device including

address signal generating means for generating a readout address signal of said picture signals stored in said frame buffer so that the picture signals will be read out from said frame buffer on a display picture surface as an array of m × n reduced-size pictures, where m and n denote natural numbers.

4. An address signal generating method for generating an address signal for reading out picture signals from a frame buffer, said address signal generating method including

an address signal generating step of generating a readout address signal of said picture signals stored in said frame buffer so that the picture signals will be read out from said frame buffer on a display picture surface as an array of m × n reduced-size pictures, where m and n denote natural numbers.

5. An address signal generating program for having a computer execute a process of generating an address signal for reading out picture signals from a frame buffer, said address signal generating program allowing a computer to execute

an address signal generating step of generating readout address signals of

said picture signals stored in said frame buffer so that the picture signals will be read out from said frame buffer on a display picture surface as an array of m × n reduced-size pictures, where m and n denote natural numbers.

6. A special effect device in which picture signals are read out from a frame buffer based on an address signal to impart a desired special effect to the picture signals read out from said frame buffer, said special effect device comprising

readout address signal generating means for generating readout address signals of said picture signals stored in said frame buffer so that the picture signals will be output from said frame buffer as a picture rotated a predetermined amount of rotation about an optional point, as set on said picture signals stored in said frame buffer, as the center of rotation.

7. The special effect device according to claim 6 wherein, with the amount of rotation of said picture fixRotate and with the location in the rectangular coordinate system of said point of rotation (cx, cy), said readout address signal generating means generates a readout address signal (R, θ) on the polar coordinate of said picture signals outputting the rotated picture by the following equation (2-3):

$$R = r$$

$$\Theta = f_1(\theta) \qquad (2\text{-}3)$$

which satisfies the following equation (2-4):

$$f_1(\theta) = \theta - \text{fixRotate} \times 2\pi \qquad (2\text{-}4)$$

said readout address signal generating means converting the readout address signal

(R, Θ) on said polar coordinate system to a signal on the rectangular coordinate system by the following equation (2–5):

$$X0 = R \cos \Theta$$

$$Y0 = R \sin \Theta \qquad (2\text{-}5)$$

to generate a readout address signal (X0, Y0);

said readout address signal generating means also generating a readout address signal (X, Y), having (cx, cy) as the center of rotation, by the following equation (2-6):

$$X = X0 + cx$$

$$Y = Y0 + cy \qquad (2\text{-}6).$$

8. An address signal generating device for generating an address signal for reading out picture signals from a frame buffer, said address signal generating device comprising

readout address signal generating means for generating readout address signals of said picture signals stored in said frame buffer so that the picture signals will be output from said frame buffer as a picture rotated a predetermined amount of rotation about an optional point, as set on said picture signals stored in said frame buffer, as the center of rotation.

9. An address signal generating method for generating an address signal for reading out picture signals from a frame buffer, said address signal generating method comprising

a readout address signal generating step of generating readout address signals of said picture signals stored in said frame buffer so that the picture signals will be output from said frame buffer as a picture rotated a predetermined amount of rotation about an optional point, as set on said picture signals stored in said frame buffer, as the center of rotation.

10. An address signal generating program for having a computer execute a process of generating an address signal for reading out picture signals from a frame buffer, said address signal generating program allowing a computer to execute

a readout address signal generating step of generating a readout address signal of said picture signals stored in said frame buffer so that the picture signals will be output from said frame buffer as a picture rotated a predetermined amount of rotation about an optional point, as set on said picture signals stored in said frame buffer, as the center of rotation.

11. A special effect device in which picture signals are read out from a frame buffer based on an address signal to impart a desired special effect to the picture signals read out from said frame buffer, said special effect device comprising

address signal generating means for generating a readout address signal of said picture signals stored in said frame buffer so that the picture signals will be output from said frame buffer with an offset movement of a predetermined amount in the vertical direction or in the horizontal direction and so that picture signals corresponding to a picture portion protruded to outside a display area during

display as a result of said offset movement will be output in a void area formed on the opposite side to the direction of the offset movement.

12. The special effect device according to claim 11 wherein said address signal generating means generates the readout address signal of said picture signals, stored in said frame buffer, so that, in each of a plurality of picture areas, obtained on fractionating said picture signals in the vertical direction or in the horizontal direction, the picture signals corresponding to each area are output with an offset of a predetermined quantity in the vertical direction or in the horizontal direction, and so that picture signals corresponding to a picture portion protruded to outside a display area during display as a result of said offset movement will be output in a void area formed on the opposite side to the direction of the offset movement.

13. The special effect device according to claim 12 wherein, with a width of an output picture being W, a height of the picture being H, a left boundary position in fractionating the picture signals in the vertical direction being x1, a right boundary position in fractionating the picture signals in the vertical direction being x2, said preset offset quantity for areas $0 \leq x0 < x1$, $x1 \leq x0 < x2$ and $x2 \leq x0 < W$ being fixOffset1, fixOffset2 and fixOffset3, respectively, said address signal generating means generates a readout address signal (X0, Y0) of each fractionated area output with an offset in the vertical direction by the following equation (3-2):

$$X0 = x0$$

$$Y0 = f_2(y0 - f_1(x0)) \qquad (3\text{-}2)$$

which satisfies the equations (3-3) and (3-4):

$$f_1(x0)=\begin{cases}\text{fixOffset1}\times H & (0 \le x0 < x_1)\\ \text{fixOffset2}\times H & (x_1 \le x0 < x_2)\\ \text{fixOffset3}\times H & (x_2 \le x0 < W)\end{cases} \quad (3\text{-}3)$$

$$f_2(y) = y(\text{mod } H) \quad (3\text{-}4)$$

where

W = picture width

H = (post-crop) picture height

$x_1 = 0.5W(1 + \text{fixBoundary1})$

$x_2 = 0.5W(1 + \text{fixBoundary2})$

and wherein said address signal generating means generates, by the equation (3-5):

$$X = X0 + cx$$

$$Y = Y0 + cy \quad (3\text{-}5)$$

a readout address signal (X, Y) for a case where the point of origin on the rectangular coordinate system of the picture signals is (cx, cy).

14. The special effect device according to claim 12 wherein, with a width of an output picture being W, a height of the picture being H, the lower boundary position in fractionating the picture signals in the horizontal direction being y1, the upper boundary position in fractionating the picture signals in the horizontal direction being y2, said preset offset quantity for areas $0 \le y0 < y1$, $y1 \le y0 < y2$

and $y2 \leq y0 < H$ being fixOffset1, fixOffset2 and fixOffset3, respectively, said address signal generating means generates a readout address signal (X0, Y0) of each fractionated area output with an offset in the horizontal direction by the following equation (3-7):

$$X0 = f_4(x0 - f_3(y0))$$

$$Y0 = y0 \qquad (3\text{-}7)$$

which satisfies the equations (3-8) and (3-9):

$$f_3(y0) = \begin{cases} \text{fixOffset1} \times W & (0 \leq y0 < y_1) \\ \text{fixOffset2} \times W & (y_1 \leq y0 < y_2) \\ \text{fixOffset3} \times W & (y_2 \leq y0 < H) \end{cases} \qquad (3\text{-}8)$$

$$f_4(x) = x(\text{mod } W) \qquad (3\text{-}9)$$

where

W = (post-crop) picture width

H = picture height

y1 = 0.5H(1 + fixBoundary1)

y2 = 0.5H(1 + fixBoundary2)

and wherein said address signal generating means generates, by the equation (3-10):

$$X = X0 + cx$$

$$Y = Y0 + cy \qquad (3\text{-}10)$$

a readout address signal (X, Y) for a case where the point of origin in the rectangular coordinate system of the picture signals is (cx, cy).

15. An address signal generating device for generating an address signal for reading out picture signals from a frame buffer, said address signal generating device comprising

address signal generating means for generating a readout address signal of said picture signals stored in said frame buffer so that the picture signals will be output from said frame buffer with an offset movement of a predetermined amount in the vertical direction or in the horizontal direction and so that picture signals corresponding to a picture portion protruded to outside a display area during display as a result of said offset movement will be output in a void area formed on the opposite side to the direction of the offset movement.

16. The special effect device according to claim 15 wherein said address signal generating means generates the readout address signals of said picture signals, stored in said frame buffer, so that, in each of a plurality of picture areas, obtained on fractionating said picture signals in the vertical direction or in the horizontal direction, the picture signals corresponding to each area are output with an offset movement of a predetermined quantity in the vertical direction or in the horizontal direction, and so that picture signals corresponding to a picture portion protruded to outside a display area during display as a result of said offset movement will be output in a void area formed on the opposite side to the direction of the offset

movement.

17. An address signal generating method for generating an address signal for reading out picture signals from a frame buffer, said address signal generating method comprising

an address signal generating step of generating a readout address signal of said picture signals stored in said frame buffer so that the picture signals will be output from said frame buffer with an offset movement of a predetermined amount in the vertical direction or in the horizontal direction and so that picture signals corresponding to a picture portion protruded to outside a display area during display as a result of said offset movement will be output in a void area formed on the opposite side to the direction of the offset movement.

18. The address signal generating method according to claim 17 wherein said address signal generating means generates the readout address signal of said picture signals, stored in said frame buffer, so that, in each of a plurality of picture areas, obtained on fractionating said picture signals in the vertical direction or in the horizontal direction, the picture signals corresponding to each area are output with an offset movement of a predetermined quantity in the vertical direction or in the horizontal direction, and so that picture signals corresponding to a picture portion protruded to outside a display area during display as a result of said offset movement will be output in a void area formed on the opposite side to the direction of the offset movement.

19. An address signal generating program for having a computer execute a process for generating an address signal for reading out picture signals from a frame buffer, said address signal generating program allowing a computer to execute an address signal generating process for generating a readout address signal of said picture signals stored in said frame buffer so that the picture signals will be output from said frame buffer with an offset movement of a predetermined amount in the vertical direction or in the horizontal direction and so that picture signals corresponding to a picture portion protruded to outside a display area during display as a result of said offset movement will be output in a void area formed on the opposite side to the direction of the offset movement.

20. The address signal generating program according to claim 19 wherein said address signal generating step generates the readout address signal of said picture signals, stored in said frame buffer, so that, in each of a plurality of picture areas, obtained on fractionating said picture signals in the vertical direction or in the horizontal direction, the picture signals corresponding to each area are output with an offset movement of a predetermined quantity in the vertical direction or in the horizontal direction, and so that picture signals corresponding to a picture portion protruded to outside a display area during display as a result of said offset movement will be output in a void area formed on the opposite side to the direction of the offset movement.

21. A special effect device in which picture signals are read out from a frame

buffer based on an address signal to impart a desired special effect to the picture signals read out from said frame buffer, said special effect device comprising

address signal generating means for generating a readout address signal of said picture signals stored in said frame buffer so that the same picture signals will be output in each of a plurality of triangular areas of a preset size fractionated from said picture signals stored in said frame buffer.

22. The special effect device according to claim 21 wherein said address signal generating means generates the readout address signal of said picture signals stored in said frame buffer so that the totality of picture signals output in each triangular area will be preset picture signals of the same sort from one of the triangular areas to another.

23. The special effect device according to claim 22 wherein, with the bottom side and the height of a triangle fractionated from said picture signals being Wy and Wx, respectively, said address signal generating means generates a readout address signal (X0, Y0) for reading out picture signals in an area of said triangle in case the center of said picture signals is at the point of origin of a rectangular coordinate system by the equation (4-2):

$$X0 = f_1(x0)$$

$$Y0 = f_2(y0 + f_3(x0) \times f_4(y0) \qquad (4\text{-}2)$$

which satisfies the equations (4-3), (4-4), (4-5) and (4-6):

$$f_1(x0)=\left(\left[\frac{x0}{w_x}\right]+0.5\right)\times w_x \tag{4-3}$$

$$f_2(y)=\left[\frac{y+0.25\times w_y}{0.5\times w_y}\right]+0.5\times w_y \tag{4-4}$$

$$f_3(x0)=\begin{cases}\dfrac{x0(\mathrm{mod}\, w_x)}{w_x}-0.5 & (x(\mathrm{mod}\, 2w_x)\leqq w_x)\\ 0.5-\dfrac{x0(\mathrm{mod}\, w_x)}{w_x}-0.5 & (x(\mathrm{mod}\, 2w_x)> w_x)\end{cases} \tag{4-5}$$

$$f_4(y0)=\begin{cases}w_y & (y0(\mathrm{mod}\, w_y)\leq 0.5\times w_y)\\ -w_y & (y0(\mathrm{mod}\, w_y)> 0.5\times w_y)\end{cases} \tag{4-6}$$

where

w_x = fixWidthX × picture width

w_y = fixWidthY × picture height

[ ] is the Gaussian symbol;

and wherein said address signal generating means generates, by the wquation (4-7):

X = X0 + cx

Y = Y0 + cy (4-7)

said address signal generating means also generating a readout signal (X, Y) in case the position of the point of origin in the rectangular coordinate system of said picture signals is (cx, cy).

24. An address signal generating device for generating an address signal for reading out picture signals from a frame buffer, said address signal generating device comprising

address signal generating means for generating a readout address signal of said picture signals stored in said frame buffer so that the same picture signals will be output in each of a plurality of triangular areas of a preset size fractionated from said picture signals stored in said frame buffer.

25. The address signal generating device according to claim 24 wherein said address signal generating means generates the readout address signal of said picture signals stored in said frame buffer so that the totality of picture signals output in each triangular area will be preset picture signals of the same sort from one of the triangular areas to another.

26. An address signal generating method for generating an address signal for reading out picture signals from a frame buffer, said method address signal generating method comprising

an address signal generating step of generating a readout address signal of said picture signals stored in said frame buffer so that the same picture signals will be output from said frame buffer in each of a plurality of triangular areas of a preset

size fractionated from said picture signals stored in said frame buffer.

27. The address signal generating method according to claim 26 wherein said address signal generating step generates the readout address signal of said picture signals stored in said frame buffer so that the totality of picture signals output in each triangular area will be preset picture signals of the same sort from one of the triangular areas to another.

28. An address generating program for having a computer execute an address signal generating process of generating an address signal for reading out picture signals from a frame buffer, wherein said address generating program allows the computer to execute an address signal generating step of generating a readout address signal of said picture signals stored in said frame buffer so that the same picture signals will be output in each of a plurality of triangular areas of a preset size fractionated from said picture signals stored in said frame buffer.

29. The address generating program according to claim 28 wherein the address signal generating step executed by said computer generates the readout address signal of said picture signals stored in said frame buffer so that the totality of picture signals output in each triangular area will be preset picture signals of the same sort from one of the triangular areas to another.